WASHINGTON STATE DEPARTMENT OF ECOLOGY

Questions & Answers

An Overview of the Instream Flow Incremental Methodology

Q: ***How much water does a fish need?***

A: That question is being asked by a number of people today--including those who want to use water to accommodate new growth, and those who fear instream flows are already too low for fish. While everyone agrees fish need water to survive, not everyone agrees how much. There are ways to answer the question scientifically. One method often used by the Washington Departments of Ecology and Fish and Wildlife is the Instream Flow Incremental Methodology, or IFIM.

Q: ***What is IFIM?***

A: IFIM refers to a series of computer-based models that quantify the amount of fish habitat with different flow levels in a river or stream. These models can accurately predict the water depths and velocities in the river at different flows. IFIM was developed in the late 1970s by the United States Fish and Wildlife Service's Instream Flow Group at Colorado State University. It is the most widely-used and accepted method for evaluating instream flow needs for fish habitat. The Department of Ecology has relied on IFIM for more than a decade and has conducted IFIM studies on many rivers and streams across the state.

IFIM is based on the understanding that fish prefer water with a certain depth and velocity. This preference varies for different species of fish, and for each of their life stages. At certain flows, for example, the water may be too fast for juvenile fish or velocities may be too high for fish to spawn. At other flows, the water may be too shallow for spawning or suitable spawning gravel may not be covered by water. What kind of gravel (or substrate) covers the river bottom is important to fish, especially for spawning. Substrate is a variable addressed by the IFIM models. In short, flow determines the kind of activities fish can engage in at particular spots in a river.

Of course, the quality of fish habitat depends on a number of other complexities. Fish also may prefer protective, cooling cover provided by large woody debris, overhanging vegetation and undercut streambanks. IFIM does not address all streamflow-related variables (e.g., predation, territoriality and competition, water quality, etc.) that may affect fish production. Other habitat information also needs to be considered.

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Q: ***How are IFM studies done?***

A: IFIM studies are complex and are usually done by a qualified expert with training in IFIM and a background in hydrology and fish biology. IFIM studies begin with the investigator researching the history of a river to determine what fish species are present and to understand their life histories. The investigator will want to know, for example, when and where fish typically spawn and rear, and what kind of habitat is found in the river. The investigator will review written reports and talk to biologists knowledgeable about fish in the study river.

Q: ***What do biologists do in the field?***

A: In consultation with other biologists, the investigator identifies appropriate study sites. Because it is not feasible to study every square foot of a river, selected study sites are used to represent larger river segments. At each study site, the investigator will establish transects (basically, a straight line marked by a tape measure) across the river. The investigator will measure the depth and velocity of the river at fixed points along each transect and record other information about the habitat, such as what kind of substrate is present at each point. The investigator will return often to measure these points at high, medium and low flows. This provides a range of depths and velocities to calibrate the computer models.

These visits are planned by first reviewing the hydrologic history of the river. Often, an investigator also will snorkel the river and observe what kind of fish are present in the river, what kind of areas they are using and what they are doing (rearing, spawning, holding). The investigator will record the depths, velocities and substrates used by the fish. This information is used to model the fishes' habitat preferences.

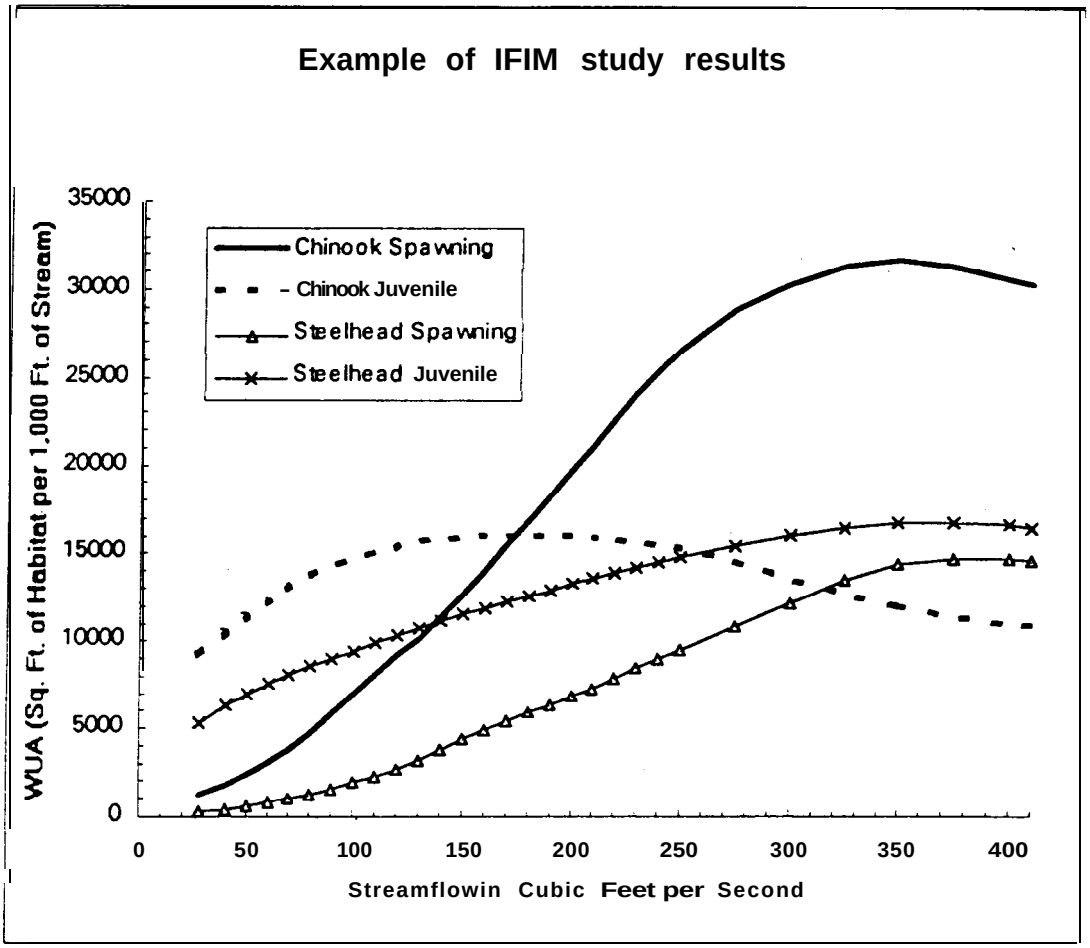
Q: ***What is done with the data?***

A: The data gathered during the field investigations is then entered into a computer program which is able to model and predict how a specified range of flows affect the distribution of water depths and velocities. These results then need to be reviewed and calibrated.

These results do not indicate how fish habitat is affected by flow changes. The data then must be entered into another computer model along with information describing habitat preferences by various species and life stages. This information may indicate, for example, that adult steelhead prefer water of a certain depth and velocity, while juvenile coho salmon prefer water of different depth and velocity.

Q: ***What is the outcome of IFIM?***

A The outcome of this model calculation produces a value known as "weighted usable area," or WUA, for each species and life stage of interest. WUA expresses (in square feet per 1,000 feet of stream) how the availability of fish habitat is affected by changes in flow levels. The information can be easily illustrated as a graph. Finally, model results need to be verified.



Q: ***How is an IFIM s study used?***

A Because different species and life stages have different flow needs, no single flow level can simultaneously maximize habitat for all species. The challenge is to reconcile these varying flow needs in a way that adequately protects all species. This requires fish biologists to use the model results in combination with other information to develop a final "flow regime." This may involve some negotiation and clarification of management priorities. Other streamflow-related values, like channel maintenance and recreation, also need to be considered.

IFIM allows investigators to model flows that actually are not observed, or that have not been present for a long time. A number of Washington rivers, for example, have been subject to extensive withdrawals and diversions. Land use practices also affect streamflows. Flows may no longer match historic levels. Nonetheless, with sufficient water, presently dry portions of river channels could once again become suitable fish habitat. An IFIM study can provide an indication of habitat loss as a result of reduced flows.

IFIM studies often indicate that optimum flow levels exceed those that actually occur during parts of the year. In Washington, streams typically reach low levels in late summer and early fall because of low rainfall. Fish would not remain productive if stream levels stayed low all year, just as plants could not survive a year-long drought period. Thus, IFIM studies help indicate whether surplus water is available for out-of-stream uses.

Q: ***What are the advantages of IFIM?***

A: IFIM is invaluable for water resources managers. To effectively protect rivers, managers must understand how flow reductions affect fish habitat. By providing the ability to illustrate this relationship for all species and life stages, IFIM allows managers to consider different needs in reaching a balanced decision. IFIM provides a rational framework within which to address streamflow issues in a scientific, quantifiable and flexible manner.

For More Information

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IFIM technical reference documents are available from the National Biological Service, Midcontinent Ecological Science Center, 4512 McMurry Ave., Fort Collins, CO 80525-3400.

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